

A NEW SPECIES OF *PHANAEUS* FROM MEXICO
(COLEOPTERA: SCARABAEIDAE)

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Phanaeus is a New World genus of dung beetles well known for bright, metallic colors and striking sexual dimorphism. The purpose of this paper is to describe a new Mexican species with unusual ecological characteristics. The primary geographical center of diversity of *Phanaeus* is tropical Mexico (Edmonds, 1972). Rather than to Mexican groups, however, the new species is more closely related to those Central and South American species which comprise the *P. splendidulus*-group (Edmonds, 1972). Of these species, it is most closely related to *P. endymion* Harold, the only other member which also occurs in Mexico.

***Phanaeus halffterorum*, new species**
(Figs. 1-3, 6-8)

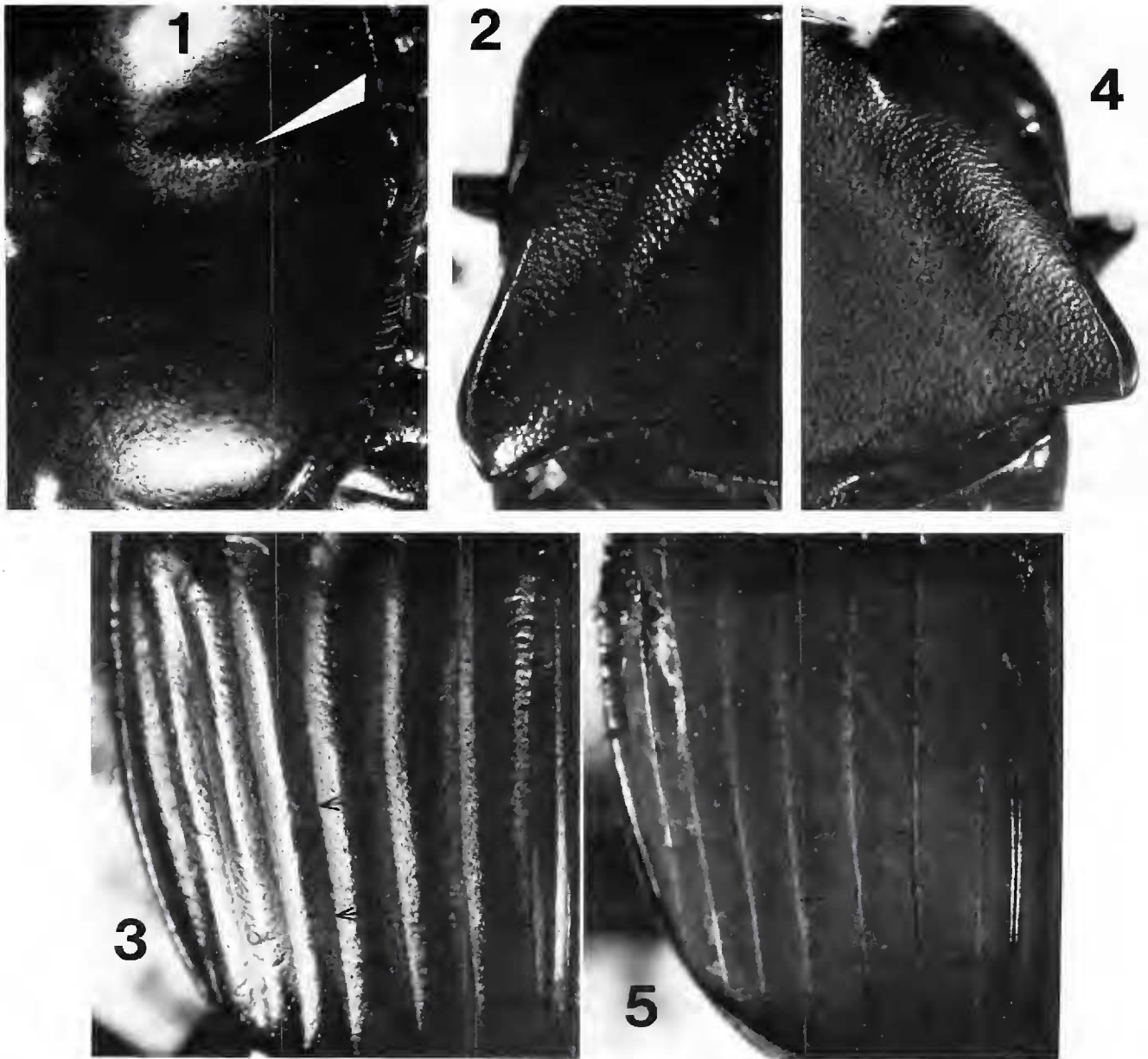
Holotype.—Male, Mexico, state of Mexico, 8 km W Temascaltepec, 2360 m, VII-11-76, fungus in pine-oak forest, W. D. Edmonds, P. Reyes and B. Kohlmann.

Paratypes.—3 males, 2 females, same data as holotype; 4 males, 4 females (1 designated allotype), 5 km E Temascaltepec, Real de Arriba, 2200 m, VII-10-76, fungus in oak-pine forest, W. D. Edmonds, P. Reyes, B. Kohlmann; 1 male, 1 female, 5 km W Temascaltepec, 2200 m, fungus in oak-pine forest, VII-23-77, W. D. and T. B. Edmonds; 1 male labeled "Real de Arriba, VII-1932, 6300 ft, Mexico D. F., Hinton coll., BM 1939-583"¹; 1 male labeled "Mex. Guerrero, 22 mi S Chilpancingo, 2800 ft, VIII-2-1964, Richard D. Page, col."

Disposition of types.—Holotype and allotype—California Academy of Sciences, San Francisco (CAS Ent., Type 13184); 1 pair paratypes—British Museum (Natural History), London; 1 pair paratypes—Halffter collection, Mexico City; 1 male paratype—United States National Museum, Washington, D.C.; 1 male paratype—A. Martínez collection, Buenos Aires; remaining paratypes—temporarily in my collection.

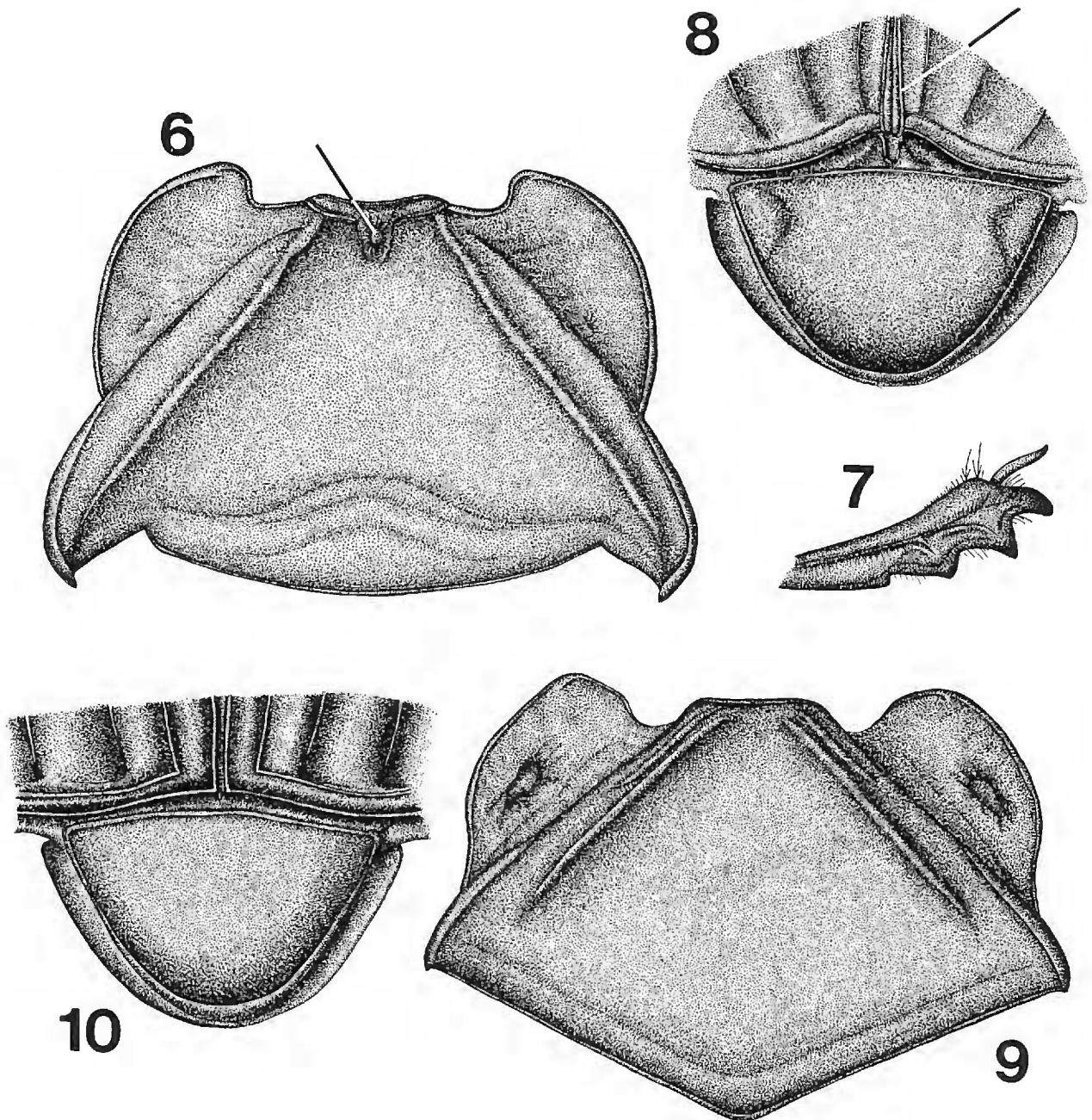
Derivation of epithet.—From the surname Halffter. It is my pleasure to dedicate this species to my very good friends and colleagues, Gonzalo Halffter and his lovely wife Violeta M. de Halffter, in recognition of their many contributions to the study of Scarabaeinae.

Major male.—Dorsum dark, shining, iridescent green or dark blue (iri-



Figs. 1–5. Figs. 1–3. *Phanaeus halffterorum*: Fig. 1—dorsal view female pronotum (arrow indicates mid-dorsal depression); Fig. 2—dorsal view left side male pronotum; Fig. 3—dorsal view left elytron of male (arrows indicate 4th stria). Fig. 4—*Phanaeus endymion*, dorsal view right side male pronotum. Fig. 5—*Phanaeus funereus*, dorsal view left elytron of male (arrow indicates 4th stria).

descence subdued on elytra) except outer margin of head, cephalic process (“horn”),² posterior part of head and lower surface of posterior pronotal angles, which are shining black; venter red-brown to chocolate-brown except abdominal sterna, middle and hind femora and pteropleura, which are tinged with green (or blue). Clypeus distinctly bidentate, teeth rounded; subclypeal process transverse. Cephalic process long, tapering, curved evenly posteriorly over pronotum. Prothoracic disk (Fig. 6) triangular, flattened but with distinct undulations laterally and posteriorly; posterior angles very salient, directed posterolaterally and slightly upturned apically; middle of anterior margin with a strong, acute tooth (except Guerrero specimen);



Figs. 6–10. Figs. 6–8. *Phanaeus halffterorum*, male: Fig. 6—dorsal view pronotum (guideline indicates anterior tooth); Fig. 7—right front tibia; Fig. 8—caudal view tips of elytra, pygidium and 8th abdominal sternum (guideline indicates raised inner margin of elytron). Figs. 9–10. *Phanaeus endymion*, male: Fig. 9—dorsal view pronotum; Fig. 10—caudal view tips of elytra, pygidium and 8th abdominal sternum.

pronotum distinctly granulate dorsally (Fig. 2), granulation, while better appreciated under magnification, visible as fine texturing (like that of sandpaper) to unaided eye; sculpturing becoming punctate posteriorly and progressively more clearly punctate and less granulate anterolaterally; disk shagreened and highly shining. Front tibia quadridentate (Fig. 7). Elytra (Fig. 3) with very fine, simple striae, interstriae distinctly convex medially such that striae lie in longitudinal furrows; inner margin a ridge progressively more raised and keel-like posteriorly which extends beyond apical margin of elytron as rounded tooth (Fig. 8); lateral margin of elytron distinctly

excised apically adjacent to inner margin. Pygidium (Fig. 8) weakly to moderately punctate, punctures usually coalescent at least medially; each side with shallow elongate depression.

Minor male.—As above except as follows: Cephalic process shorter, more upright or reduced to a simple tubercle; flattened, triangular shape of pronotum much less pronounced, posterior angles reduced to tubercles well anterior to posterior margin, anterior tooth absent.

Female.—As above except as follows: Cephalic process a trituberculate, transverse carina extending between ends of postclypeal carinae; most of pronotal disk shining black, green color not iridescent (blue phase known in male only). Pronotum evenly covered dorsally with shallow punctures, appearing very smooth to unaided eye; puncturing sometimes effaced medially and coalescing laterally to produce weak rugosity; surface not shagreened, coloring (where present) less brilliant than in male; strongly convex, bearing weakly raised anterior transverse ridge with three isolated tubercles followed by shallow concavity; distinct mid-longitudinal depression extending from posterior margin to near middle of disk (Fig. 1, arrow).

Size.—Length 12–19 mm; width (at bases of elytra) 8–12 mm.

Habitat and distribution.—Temperate oak-pine/pine-oak forests ordinarily above 1900 m along southern slopes of the Transverse Volcanic Range and in the highlands of Guerrero, Mexico; feeding on wild mushrooms; probably active at dusk and early evening hours.

Discussion

This species is the same mentioned by me in 1972 as *incertae sedis* (p. 830); females, which were not available then, indicate without doubt that *P. halffterorum* is a member of the *endymion*-complex of the *P. splendidulus*-group. Pronotal sculpturing of the male, however, requires that the second alternative of the first couplet of my key to the species groups and complexes of *Phanaeus* (p. 829) be modified partially to read as follows: “. . . or minutely to distinctly granulate or granulorugose (males of *endymion* complex)” *P. endymion* differs from *halffterorum* by the following combination of characters, the counterparts of which are included in the above description: the color is weakly shining green or blue and never highly iridescent on the head and pronotum of the male; most of the disk of the female is colored, less of it is black; the pronotum of the large males (Fig. 10) is more broadly triangular, very flat, and the posterior angles are less salient and directed laterad; even the largest males are without a trace of an anterior pronotal tooth; the pronotum of the female has at most a fine mid-dorsal, longitudinal line on the posterior part of the pronotum and is never distinctly impressed along this line; the disk of the male pronotum (Fig. 4) is at most only weakly granulorugose, appearing virtually smooth

to the unaided eye and, seen under magnification, often with minute widely spaced, shining punctures in a field of effaced granules and weak shagreening; the inner margin of the elytron is not ridge-like, lacks an apical tooth and is not excised (Fig. 10); the pygidium (Fig. 10) lacks indications of lateral depressions; the species inhabits lowland evergreen and deciduous forests of eastern and southeastern Mexico and Guatemala below 800 m, feeds on excrement of non-herbivores and, occasionally, carrion; active during early morning hours.

The most useful morphological features for distinguishing *halffterorum* from other members of the complex are the shape and sculpturing of the male pronotum and the strong ridge along the inner margin of each elytron. Most groups of *Phanaeus*, including the *endymion*-complex, are in need of revision. I have insufficient data to reliably distinguish among the other, currently recognized members of the complex, *blanchardi* Olsoufieff, *funereus* Balthasar, and *pyrois* Bates, all of which are from Central or north-west South America and presumed to be reasonable taxonomic species. Collectively, however, these three species differ from *halffterorum* and *endymion* by the following characters: the elytral interstriae are relatively flat, the striae are very fine and not lying in pronounced longitudinal depressions (Fig. 5); the disk of the male pronotum is without granulations, appearing smooth even under magnification, except for weak roughening anterolaterally; the elytra and most or nearly all of the pronotum are dull black, not shining; or, if a shining red color present (*pyrois*), it is restricted to the pronotum.

The Guerrero specimen, which is a large male, differs from those collected in Temascaltepec by the lack of an anterior pronotal tooth, by being less distinctly granulate and darker, less shining green. It is interesting that *halffterorum* is evidently more widely distributed geographically than the special ecological conditions of Temascaltepec might lead one to predict. I do not know the Guerrero locality, but the elevation (2400 ft, 735 m) suggests a significantly different ecological setting from that of the environs of Temascaltepec. The ecological comments below are based on observations made in the Temascaltepec area.

Temascaltepec is located on the southern slopes of the Transverse Volcanic Range at 19°02'N, 100°02'W. The area supports extensive stands of oak-pine to pine-oak forests on very uneven terrain. All specimens collected there have come from inside or near the margins of the forests between 1935 and 2360 m (6350 and 7750 ft). As was originally reported by Hinton (1935) and later by Halffter and Matthews (1966), who referred to this species as *endymion*, *P. halffterorum* is mycetophagous and attracted only to several species of wild mushrooms (none yet identified) common during the rainy season. It has never been found associated with excrement of the many domestic animals (cattle, horses, burros, swine) which roam the area nor in

human excrement or carrion used to bait pitfall traps. When partially decomposed, mushrooms are treated by adults as is excrement or carrion by other *Phanaeus*: beginning with the stalk, the fungus is packed by pieces into the blind end of a tunnel dug directly beneath it. Here it is either consumed by the adults or used to fashion brood balls.

Mycetophagy by scarabaeine dung beetles has been known for many years. While many species have been collected from decomposing fungi (see Halffter and Matthews, 1966), very few appear to be as strictly mycetophagous as is *halffterorum*. The following have also been collected from wild mushrooms in the Temascaltepec area, although only the former is evidently strictly mycetophagous: *Oniticellus rhinocerulus* Bates; *Phanaeus daphnis* Harold (Hinton, 1935), otherwise very common in cattle dung; one species each (not yet identified) of *Ateuchus* and *Onthophagus* which are more commonly collected in cattle and horse dung.

The southern slopes of the Transverse Volcanic Range are interrupted by a series of valley systems which descend steeply to the valley of the Balsas River. Temascaltepec is located near the upper (northern) end of one such valley system. Of zoogeographic interest is the fact that Temascaltepec, like similar places along the Transverse Volcanic Range, supports a dung beetle fauna which comprises both nearctic and neotropical elements. *Copris*, *Onthophagus*, *Oniticellus* and *Ceratoptrupes* (Geotrupinae) are northern contributions; *Phanaeus*, *Ateuchus*, *Canthidium*, *Deltochilum*, *Dichotomius* and *Coprophanaeus* are southern representatives. Such faunal mixing in the Mexican transition zone has been discussed by Halffter (1964, 1976). In accordance with ideas I presented in 1972, *P. halffterorum* can be interpreted as the product of relatively recent speciation; it undoubtedly represents the deepest northward eco-geographic penetration of the *P. splendidus*-group into North America.

P. halffterorum has been successfully reared in the laboratory. Two pairs of field-collected adults were introduced into the same vertical terrarium (95 × 60 × 7 cm) on 12 July, 1976, and provided decomposing fungi from the type locality. Later, partially decomposed commercial (edible) mushrooms were provided to replace the original food supply, which was buried quickly. Four brood balls were recovered on 14 September; all nesting details agreed with those of other known *Phanaeus* (Halffter and Matthews, 1966; Halffter, 1977). A fifth brood ball was recovered on October 6, at which time surviving adults (1 male, 2 females) were supplied with human excrement. A sixth brood ball, provisioned with human excrement, was recovered on 8 November; it yielded an egg in early stages of decomposition. Although field and laboratory data may suggest strict mycetophagy, further rearing trials with excrement are necessary before concluding whether or not *halffterorum* requires fungi for successful nidification. All five

fungus-provisioned brood balls yielded eggs which were allowed to develop to 3rd (final) instar larvae. The larva of *halffterorum* is virtually identical to those of other known phanaeines (Edmonds and Halffter, 1978).

Acknowledgments

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Footnotes

¹ This specimen is evidently one of the series of eleven referred to by Hinton, 1935. I have been unable to locate the remaining ten specimens.

² Terminology used here is that established by Edmonds, 1972.